ASTRONOMY

Venus at Greatest Brilliance

Venus will reach its maximum brilliance and the fifth of the naked-eye planets, Mercury, will come into view in the October sky, James Stokley reports.

➤ THE PLANET VENUS, which has been so prominent in the western evening sky for the past few months, will reach maximum brilliance on Oct. 8.

This is her last fling, however, for by the end of October Venus will have virtually disappeared, with a close approach to the sun's direction.

Three other planets—Saturn, Jupiter and Mars—are also visible in the evening. And Mercury, the fifth of the naked-eye planets, comes into view before sunrise about Oct. 21.

Only Saturn and Jupiter are shown on the accompanying maps, which give the appearance of the skies about ten o'clock (your own kind of standard time) at the beginning of October; an hour earlier in the middle of the month and two hours earlier at the end. Venus sets too early, and Mars rises too late to be shown.

Venus Visible in Daylight

Venus sets about an hour and a half after the sun on Oct. 1. Even then it is practically as bright as it will be on the 8th—of magnitude minus 4.3 on the astronomical scale. This makes it far brighter than any other planet, or any star. It is visible long before the others, while the sky is still quite bright.

In fact, Venus can be seen even while the sun is shining, if you are shaded from the direct sunlight, and know just where to look.

Jupiter's magnitude in October is minus 2.3. Although this is less than a sixth as bright as Venus, it is still about 15 times brighter than Saturn. And even that planet equals a bright first magnitude star. Jupiter is well up in the southeast, in the constellation of Aquarius, the water carrier, and it sets about two hours after midnight.

Saturn is to the right, and lower, in Capricornus, the sea-goat.

Mars, of the first magnitude this month and a little fainter than Saturn, is in Gemini, the twins, at the first of October. It rises a little before midnight. Red in color, it is easy to identify.

Among the stars, the brightest is Vega, in Lyra, the lyre, which is high in the northern half of the western sky. Above it is Deneb, in Cygnus, the swan. Altair, in Aquila, the eagle, shines to the left of Deneb, and is shown on the map for the southern sky.

Over in the northeast is another first magnitude star—Capella, in Auriga, the charioteer. And next door, to the right, is Taurus, the bull, with Aldebaran. This star is red in color, and about the same brightness as Mars which comes up later.

They need not be confused, however: Aldebaran shines with the scintillating brilliance of a star, while Mars has the steady and untwinkling glow of a planet.

Low in the south, below Jupiter, is Fomalhaut, in Piscis Austrinus, the southern fish. This is another star of the first magnitude, although it looks fainter, because it is so low in the sky. As this star is far south in the sky it never, for us, rises higher than it is now.

Above Jupiter is a group of four stars called the Great Square in Pegasus, the winged horse. Although these are not first magnitude, the square makes a good starting point in finding your way around the skies. Alpheratz, in the upper left-hand corner, is actually not in Pegasus, but in Andromeda, the princess.

The evenings of October are about the poorest of the year for seeing the familiar "great dipper," which is part of Ursa Major, the great bear. As shown on the northern sky map it is now in its lowest position, close to the horizon. For persons south of 30 degrees north latitude (about that of New Orleans) all stars but one of the great dipper go below the horizon on October evenings.

Above Ursa Major is Ursa Minor, the little bear, and in this group is Polaris, the pole star. Directly above stands Cepheus, the king (mythologically the husband of Cassiopeia, to the right, and the father of Andromeda, above).

Cepheus is not a brilliant constellation; none of its stars is as bright as the first magnitude. But in this group is a star of the fourth magnitude that is quite inconspicuous but very important to astronomers. This is delta Cephei, the easternmost of a little triangle of stars in the upper part of the constellation. It is the prototype of a class of stars known as Cepheid variables, which astronomers have found to be valuable as measuring sticks of the universe.

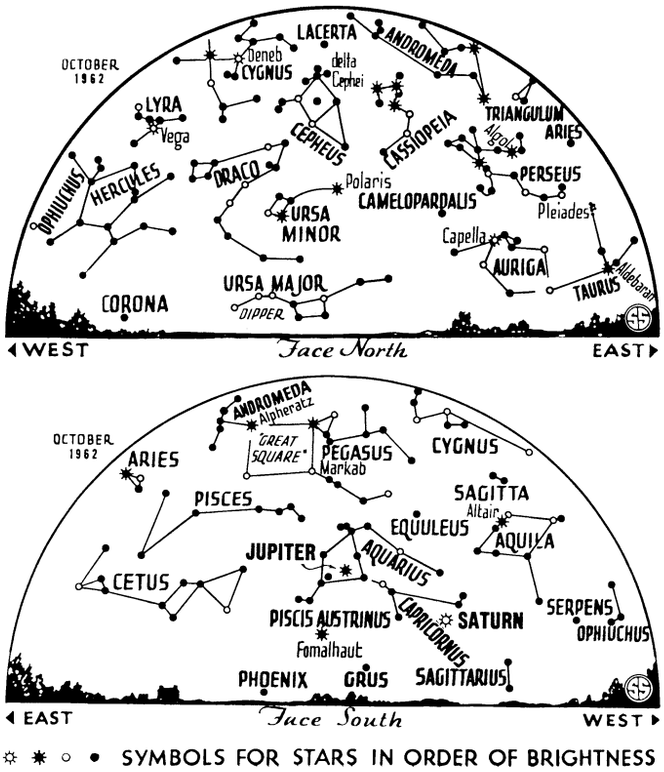
Delta Cephei a Variable Star

Delta Cephei is a variable star. From a maximum of magnitude 3.8, it drops in about four days to 4.3, about two-thirds as bright. In about a day and a half it returns to its maximum brightness; the total period of the cycle is 5.4 days.

Apparently it is pulsating. While it is expanding it is brightest, and when it is most rapidly contracting it is faintest. When at maximum brightness, it is more bluish, which indicates an increase in temperature of about 3,600 degrees.

Cepheids, like most stars, utilize nuclear energy to supply energy by a process in which hydrogen is converted to helium. According to one theory, the star contracts and this heats up its core, thus firing up the nuclear furnace that keeps it going.

Finally, so much radiation is flowing outward from the center that its pressure causes it to expand. But as it gets to maximum



✱ ☼ ✱ ○ • SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS

size, the internal temperature goes down and the nuclear furnace reduces its output. This permits it to contract again, and the cycle occurs over and over.

Delta Cephei, with a period of 5.4 days, has a mean magnitude of four. This, however, is its apparent magnitude—how bright it looks—which depends partly on its distance. A faint star nearby may outshine a brilliant one that is farther away.

So to compare the intrinsic luminosity—the candlepower—of a star, we use absolute magnitude, which is what they would be if all were at a standard distance. The mean absolute magnitude of delta Cephei is about minus 2; it is some 660 times more luminous than the sun.

For a cepheid that goes through its cycle in a day, the mean absolute magnitude would be minus 0.5, while one with a 20-day period would be ten times as bright, or minus four.

Cepheids are usually recognized from the way their light changes—brightening rapidly, dimming more slowly. Then the period of a cepheid is measured, in days and fractions. The relation between period and luminosity tells how bright the star really is (on the average); you can see how bright it looks in the sky. Knowing the effect of distance on brightness, how far away it is can be calculated.

Thus cepheid variable stars are important tools in measuring distance. Their use has been complicated in recent years as astronomers found that not all of them are alike, as they had formerly assumed. This meant that some of the distant galaxies—huge systems of stars like the whole Milky Way system, of which the earth is a part—were more than twice as far as they had formerly believed.

That is the way science advances, however: one man observes an effect and arrives at a conclusion. Then comes another who refines it, ever getting closer and closer to ultimate truth.

Celestial Time Table for October

Oct.	EST	
2	4:00 a.m.	Moon passes Venus
	4:44 a.m.	Algol (variable star in Perseus) at minimum brightness
5	1:33 a.m.	Algol at minimum
6	11:00 a.m.	Mercury between earth and sun
	2:55 p.m.	Moon at first quarter
7	10:22 p.m.	Algol at minimum
8	6:00 a.m.	Moon passes Saturn
	5:00 p.m.	Venus at greatest brilliancy
10	6:00 a.m.	Moon passes Jupiter
	7:11 p.m.	Algol at minimum
12	10:00 p.m.	Moon nearest, distance 221,800 miles
13	7:33 a.m.	Full moon
20	3:48 a.m.	Moon in last quarter
	8:00 p.m.	Moon passes Mars
21	11:00 p.m.	Mercury farthest east of sun; visible for a few days about now low in east before sunrise
25	11:00 p.m.	Moon farthest, distance 252,500 miles
26	4:00 p.m.	Moon passes Mercury
28	12:04 a.m.	Algol at minimum
	8:05 a.m.	New moon
30	8:53 p.m.	Algol at minimum

Subtract one hour for CST, two hours for MST, and three hours for PST.

• Science News Letter, 82:194 September 22, 1962

Piezometers for the measurement of pore-fluid *pressures* in earth dams have been developed.